LOWER DUWAMISH WATERWAY
SLIP 4 EARLY ACTION AREA

60% DESIGN SUBMITTAL
Design Analysis Report

INTERNAL REVIEW DRAFT

Submitted to
U.S. Environmental Protection Agency, Region 10
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2 REMOVAL STRATEGY

This section presents the overall construction and contracting strategies for implementing the NTCRA in Slip 4, and summarizes the roles of the key design and post-construction documents associated with the cleanup.

2.1 CONTROL OF SOURCES

Foremost in the removal strategy is the need to ensure upland sources of contamination in storm drainage systems are adequately controlled to minimize the potential for recontamination. While control of stormwater sources is outside the scope of this design. Ecology, King County, Seattle Public Utilities (SPU), and The Boeing Company are continuing to investigate and implement controls to address these sources (Ecology 2006). It is important that these sources are adequately controlled prior to construction of the Slip 4 removal action to minimize the potential for recontamination of Slip 4 sediments. Ecology will make the final decision regarding source control effectiveness and completeness (Ecology 2004). Following EPA and Ecology's assessment and before implementing the cleanup actions, the City of Seattle and King County will consider whether or not source control is considered adequate to prevent recontamination to levels of concern.

EPA and Ecology are expected to notify the City in early 2007 as to whether sources are adequately controlled; this time frame will allow the construction to be competitively bid and the contractor to be procured for construction in the fall of 2007.

2.2 PROPERTY ACQUISITION

The City is currently completing the acquisition of approximately 3.9 acres of land from Crowley, including the majority of the removal action area (Figure 1-3). This property transfer is expected to be completed in early 2007. The sheetpile retaining wall adjacent to the existing pier will remain Crowley property. Crowley will be responsible for any necessary improvements on their property, such as security fencing, curbs, rails, etc.

2.3 CONSTRUCTION STRATEGY

The overall construction strategy has been developed with the following goals:

- Implement the removal action in a manner that achieves the removal action objectives for the project
- Limit the short-term, construction-related impacts to aquatic resources and nearby communities

- Limit the short-term, construction-related impacts to adjacent landowners and commercial marine navigation
- Implement the design in a cost-effective manner.

The general approach to the major construction elements (in the general sequence of construction) is described below. Specific information on construction sequencing and scheduling is provided in Section 9.

2.3.1 Construction Window

The Slip 4 NTCRA is scheduled to occur during the summer 2007/winter 2008 construction season. The Washington State Hydraulic Code Rule—Saltwater Technical Provisions sets forth prohibited work times in saltwater areas (WAC 220-110-271). For Tidal Reference Area 5, in which Slip 4 is located, in-water work is prohibited from March 15–June 14 for protection of juvenile salmon migration. However, additional timing restrictions will apply for protection of other species. Requirements for any additional timing restrictions are being identified through consultation with the National Oceanic and Atmospheric Administration (NOAA) Fisheries and the U.S. Fish and Wildlife Service (USFWS), as part of the ESA consultation. These additional constraints are site- and activity-specific. For planning purposes during design, it is assumed that the natural resource agencies may identify the following restrictions on in-water activities:

- **Dredging**—prohibited from February 14–September 30
- **Capping**—prohibited from February 14–September 30.

The above restrictions have been used for developing the project schedule presented in Section 9. It is possible that the prohibited times could be modified through special measures, such as onsite monitoring for the presence of species of concern during in-water work during these prohibited periods.

It is currently anticipated that in-water dredging or capping of contaminated material will be permitted only between October 1, 2007 and February 13, 2008. It is possible that some construction elements could be completed "in-the-dry" earlier than October 1, 2007, if approved by EPA in coordination with NOAA Fisheries and USFWS.

2.3.2 Construction Access

Construction access issues are discussed in detail in Section 8. All in-water work will require coordination of vessel traffic to minimize any impediments to navigation in the project vicinity. Particular care will be required in coordinating remedial activities (dredging and capping) with Crowley Marine Services and their tenant's navigation needs. Accommodations for tribal fishing may also be required.

Construction will also require land access on land owned by Crowley Marine Services and First South Properties.

The specifications will require the contractor to plan the construction activities to minimize conflict with commercial operations. Where such conflicts cannot be avoided, the required coordination will be effected through the City and/or the EPA. The contractor will be required to describe construction access, staging, and vessel management procedures as part of their Removal Action Work Plan (RAWP).

2.3.3 Georgetown Steam Plant Outfall

Sediment accumulations within the Georgetown flume near the outfall are currently being investigated by the City. (Significant amounts of sediment accumulation extend from Slip 4 up into the 370-ft outfall segment of the flume. Such accumulations are not present at the other outfalls to Slip 4.) If not removed, the sediments near the Georgetown flume outfall could be transported into Slip 4 following the cleanup. Modifications or upgrades to the Georgetown flume outfall structure may also be necessary in coordination with this removal action to ensure proper function of the outfall structure (i.e., free-draining at a low tide), since it is currently at a lower elevation than the sediments immediately adjacent to the outfall.

The City is currently conducting preliminary engineering of alternatives for the Georgetown flume. Alternatives being considered include:

- Cleaning and re-using the existing 72-in. corrugated metal pipe (CMP) outfall. This would either include outfall structure modifications to raise the elevation of the outfall structure, or would require this removal action design to modify the cap/dredge scheme to accommodate the existing outfall structure;
- Alternatives that include abandoning the outfall structure.

A separate design for the entire Georgetown flume conveyance (from the Georgetown Steam Plant to the outfall in Slip 4) is being prepared by the City. Due to sequencing issues and permit timing, the work on the Georgetown flume conveyance is anticipated to be accomplished under the Slip 4 NTCRA authority of EPA, such that permits will not be required. The City is working with EPA to ensure that the design and construction of the flume project meets the substantive requirements of all applicable or relevant and appropriate requirements (ARARs).

The Georgetown flume conveyance design will include measures to remove or otherwise contain any substantial accumulations of sediment from the flume immediately upgradient of the outfall. The design will include removal/disposal of the sediment accumulations, and is anticipated to include abandoning the existing outfall. The

construction of the outfall abandonment will be completed before the construction of the dredging and capping components of this design.

At this writing, it is assumed that the Georgetown flume outfall will either be abandoned, or a reconfigured outfall will be present with an invert elevation of +4 ft MLLW or higher. The final dredge and cap designs in this vicinity will be compatible with the planned outfall configuration.

2.3.4 Pier Demolition

Within the project boundaries, a portion of a concrete pier currently owned by Crowley extends over the northwest bank of Slip 4 (Figure 1-3). This segment of the pier is no longer used by Crowley and will become City property. The City will be responsible for its future maintenance and/or removal. Contaminated sediments beneath the pier will be capped as part of this removal action. The Slip 4 Action Memorandum states (USEPA 2006a):

> To accommodate these actions, a portion of the existing Crowley pier may be removed from within the removal action area. During project design, the City of Seattle and King County will evaluate the most feasible approach to remediate the under-pier area and to implement long-term maintenance of that remedy. The evaluation will include consideration of effectiveness, implementability, cost, and habitat functions.

Based on the evaluation presented in Section 3, the City has determined that removal of this portion of the pier prior to remediation is the most appropriate approach to implement the removal action and maintain the sediment cap over the long term.

Portions of the pier demolition that are not considered "in-water work" (e.g., decking and piling cap removal, or removal of piling in the dry) may be conducted outside the established in-water construction window, subject to EPA approval.

The basis for the pier demolition design is provided in Section 3.

2.3.5 Water-Based and Land-Based Construction Methods

The EE/CA identified two general methods for removal of sediment and bank material:

- Construction "in-the-dry," typically using land-based construction equipment from the upland side of the site (referred to as "excavation" in the EE/CA), or
- In-water construction, typically using floating equipment (referred to as "dredging" in the EE/CA).

In summary, either construction approach could achieve the removal action objectives. Bank excavation using floating construction equipment is favored over land-based equipment due to lower costs and fewer and lesser short-term impacts to aquatic resources, nearby communities, and adjacent landowners.

Similar to the excavation considerations described above, it is expected that capping of bank areas can most efficiently be accomplished using floating equipment. Cap placement techniques are discussed in Section 5.6.

Given the lower anticipated costs and more favorable logistics, it is expected that most bidders will propose the use of floating construction equipment for most or all of the bank work. However, the technical specifications for bank excavation and capping are performance-based, and do not proscribe the use of land-based equipment for some excavation or capping activities. The contractor will propose detailed work methods in its work plan, which would require approval by the City/County and EPA.

2.3.6 Transloading of Waste Materials from Barge to Land

Waste soils, sediments, and debris will be loaded onto barges in Slip 4, and will require transloading at a nearshore location for transfer to rail or truck, and subsequent transportation to a permitted landfill. This transloading may occur either onsite or at a location outside of Slip 4; and the optimum approach may vary depending on which contractor is selected. To maintain flexibility, both options are retained in this design.

Both approaches require the contractor to establish engineering controls at the transloading site to contain and control any sediment spillage, and manage stormwater run-on, run-off, and leachate associated with the transloading operations. Section 4.3 describes the materials handling and transloading approaches. The specifications establish performance-based requirements for transloading and require the contractor to provide detailed information on their proposed transloading facility. The contractor will propose the transloading location and detailed work methods in its work plan, which will require approval by the City/County and EPA.

2.4 CONTRACTING STRATEGY

The design for the Slip 4 removal action will be issued for prospective construction contractors to bid the work. The City will award the construction contract to a qualified bidder and administer the contract. Performance-based specifications will ensure that the removal action is constructed in accordance with the requirements of the design, but will typically not specify specific means and methods for the construction.

Following the construction contract award, the City and the contractor will develop a RAWP (described in Section 2.5) that describes specific means and methods for the

construction. Construction quality control (e.g., daily progress surveys, sampling and analysis to verify import materials quality) will be the responsibility of the construction contractor, in accordance with the specifications and the RAWP. The RAWP will be subject to review and approval by the City and EPA.

The City of Seattle will provide a Resident Engineer to directly manage the contractor. Construction management (CM) support and construction quality assurance (CQA) will be accomplished by Integral, in accordance with the Construction Quality Assurance Plan (CQAP). CM/CQA will include daily oversight of construction activities, review of submittals, water quality monitoring and reporting, confirmation sampling and analysis, and associated coordination and reporting.

Throughout the construction, EPA will oversee all construction and CQA activities. Project roles and responsibilities and CQA activities are described in detail in the CQAP.

2.5 DESIGN AND POST-CONSTRUCTION DELIVERABLES

This document represents the 60% design for the project. This design builds on the information presented in the EE/CA and implements the selected removal alternative documented in USEPA's Action Memorandum (2006a). Key design and construction documents for the project, as required by the ASAOC are discussed in the following subsections.

2.5.1 Final (100%) Design Package

The Final (100%) design package will incorporate agency and stakeholder comments on the 60% design and is scheduled to be complete by January 2007. The 100% design submittal will constitute a complete design submittal, including the Design Analysis Report, all construction drawings, and specifications. The Design Analysis Report also includes an ICIP describing the institutional controls (ICs) needed to ensure the long-term effectiveness of the removal action, including the objectives and goals for each institutional control; descriptions of the portions of the site where each IC applies; descriptions of how such controls would be implemented, monitored, and enforced, and by whom and under what enforcement mechanism; a time frame for how long the ICs must remain in place; and under what circumstances such controls could be removed or terminated. The 100% design will also include a CQAP and associated sampling and analysis plan (SAP), and water quality monitoring plan (WQMP). The 100% design will be subject to agency review and final EPA approval.

2.5.2 Biological Assessment

To meet substantive and procedural requirements of the ESA, the BA identifies sensitive (threatened, endangered, proposed, or candidate) species and their habitat within the

The associated design life for chemical isolation is conservatively modeled at over 300 years; the expected actual service life of the cap is infinite.

- The operational thickness, T_o, is specified at 6 in. in unarmored areas and 12 in. in armored areas. This additional allowance accounts for the potential inaccuracies and unevenness of cap construction, and ensures that the entire capping area will be covered with at least the minimum required thickness needed for the above-described cap functions.

Based on the cap components described above, the minimum required thickness of the outfall area cap is:

T_I = **6 + 12 + 0 + 12 = 30 in. minimum required**, plus 6–12 in. (T_o) overplacement allowance.

Table 5-4 summarizes these required thickness components. In addition to this required thickness, unarmored intertidal areas have a minimum 5-ft cap thickness as described below.

5.6.2 Cap Materials and Configuration

The design analysis for estimating propwash velocities and erosion protection requirements is included in Appendix C. Based on these analyses, the mid-slip cap consists of two designs:

- **STA 2+40 to 5+50—Waterway Cap**: A single thickness of well-graded, sandy gravel ("waterway cap material"). The waterway cap material will vary in thickness from 30 in. in subtidal areas to 5 ft in intertidal areas. The waterway cap will have a 12-in. overplacement allowance for the final surface.
- **STA 5+50 to 6+70—Armored Cap**: To resist propwash, the armored cap consists of:
  - A base layer of well-graded, sandy gravel ("waterway cap material"). The waterway cap material will be a minimum of 12 in. thick and will have a 6-in. overplacement allowance for the final surface.
  - An armor layer of a graded, angular broken stone ("cap armor"). The armor layer will be a minimum 18 in. thick based on USACE design guidance (Appendix C). The armor layer will have a 6-in. overplacement allowance, for a total 12-in. overplacement allowance for the final surface.
  - Habitat mix (well-graded sandy gravel) placed over the armor layer to fill the voids in the armor. The habitat mix will be applied at 3 tons per 100 square ft, which is designed to fill the voids and leave an average 3-in.-thick layer of habitat mix on top of the armor.

Table 5-5 summarizes the cap design thicknesses and materials. With this design configuration, the mid-slip caps will vary from 30 in. to 5 ft thick, exceeding the required 24-in. thickness calculated above.

The mid-slip waterway cap provides a minimum cap thickness of 5 ft in areas that are not armored and are above -4 ft MLLW. This additional thickness is intended to provide an additional margin of safety for possible localized cap disturbance by potential shellfishing activities, and will ensure that Native American shellfishing treaty rights are not limited by the presence of the cap.

5.7 MATERIALS SPECIFICATIONS AND QUANTITIES

5.7.1 Quantities and Quality Control

Table 5-6 summarizes the estimated quantities of the cap materials. The specifications provide the required gradations and other properties of the various cap materials.

Cap materials for Slip 4 will be obtained from established upland borrow sources. Consistent with CWA 404 requirements, the capping material will be evaluated to verify that it is "clean"—that is, suitable for in-water use. The evaluation would include consideration of physical and chemical properties of the material, as appropriate. The specifications require testing of all non-rock cap materials to verify their chemical concentrations are below the SQS (or the dry-weight analogue of the SQS for materials with TOC < 0.5 percent). The contractor submittals will include documentation that the materials meet all specification requirements. No cap material will be placed until the submittals have been approved by the City and EPA.

5.7.2 Carbon Amendments

Based on the analyses described above, the filter material product (an engineered sandy gravel) will contain a minimum TOC content of 0.5 percent, which will require amendment of available upland-sourced materials. Several amendment options exist for providing this TOC content:

- **Granulated anthracite, coal, or coke breeze.** These products, respectively, have been used (or will be used) as amendments at the PSR site in Elliott Bay (completed) (USEPA 2005b); the Upriver Dam site in the Spokane River (planned) (Anchor 2006), and the Anacostia River (HSRC 2004). Although coal products contain detectable concentrations of impurities such as PAHs and metals, leachability testing has shown that these impurities are not leachable (Anchor 2006). Granulated anthracite has been used in drinking water treatment applications.